

PREFACE

Chapter 1 is the introductory chapter, which contains the basic properties of fracture mechanics, modes of fracture, approaches, stress intensity factors, energy release rate, Fredholm singular integral equation of first and second kinds, orthogonal polynomials viz., Chebyshev and Jacobi polynomials. The literature review related to edge cracks, central cracks, interfacial cracks under different kinds of mechanical and thermal loadings in anisotropic and isotropic materials have been given.

In Chapter 2, the objective of this chapter is concerned with a study of a static cruciform crack problem in an infinite orthotropic elastic medium opened by prescribed normal pressure distribution subject to steady state temperature field. The problem is reduced to the Fredholm singular integral equations of the first kind, which are solved by using Chebyshev polynomials. Analytical expressions of the stress intensity factors and crack energies are found and the numerical computations for the orthotropic elastic material Boron-Epoxy composite for different particular cases are depicted through figures. The striking feature of the chapter is the graphical presentation of the possibility of crack arrest and variations of crack energies with the variations of the arms of the cruciform crack.

Chapter 3 deals with the interactions between a central crack and a pair of outer cracks situated at the interface of orthotropic elastic half plane bonded to a dissimilar orthotropic layer with a punch. The problem is reduced to the solution of three simultaneous singular integral equations which are finally been solved using Jacobi polynomials. The phenomena of crack shielding and crack amplification have been depicted through graphs for different particular cases.

In Chapter 4, an elastostatic problem with two symmetrically located edge cracks and a centre crack in an orthotropic elastic material under normal loadings

is considered. Two harmonic functions are considered which are expressed in terms of displacement and stress components. The problem is reduced to a pair of simultaneous singular integral equations of the first kind with Cauchy-type singularities, which are solved using Chebyshev polynomials. The normalized stress intensity factors against ratios of cracks' lengths are computed for different particular cases for the orthotropic material Steel-Mylar and the results are depicted through graphs.

In Chapter 5, an elastostatic problem with two symmetrically situated edge cracks of finite lengths in two bonded orthotropic strips under the normal loadings is considered. Two harmonic functions are considered which are expressed in terms of displacement and stress components. The problem is reduced into a pair of simultaneous singular integral equations of the first kind with Cauchy-type singularities, which have been solved using Chebyshev polynomials. The analytical expressions of stress intensity factors at the tips of edge cracks are found. Variations of stress intensity factors for different depths of the strips and various cracks' lengths are shown graphically for different particular cases taking the composite with Steel-Mylar and Boron-Epoxy materials.